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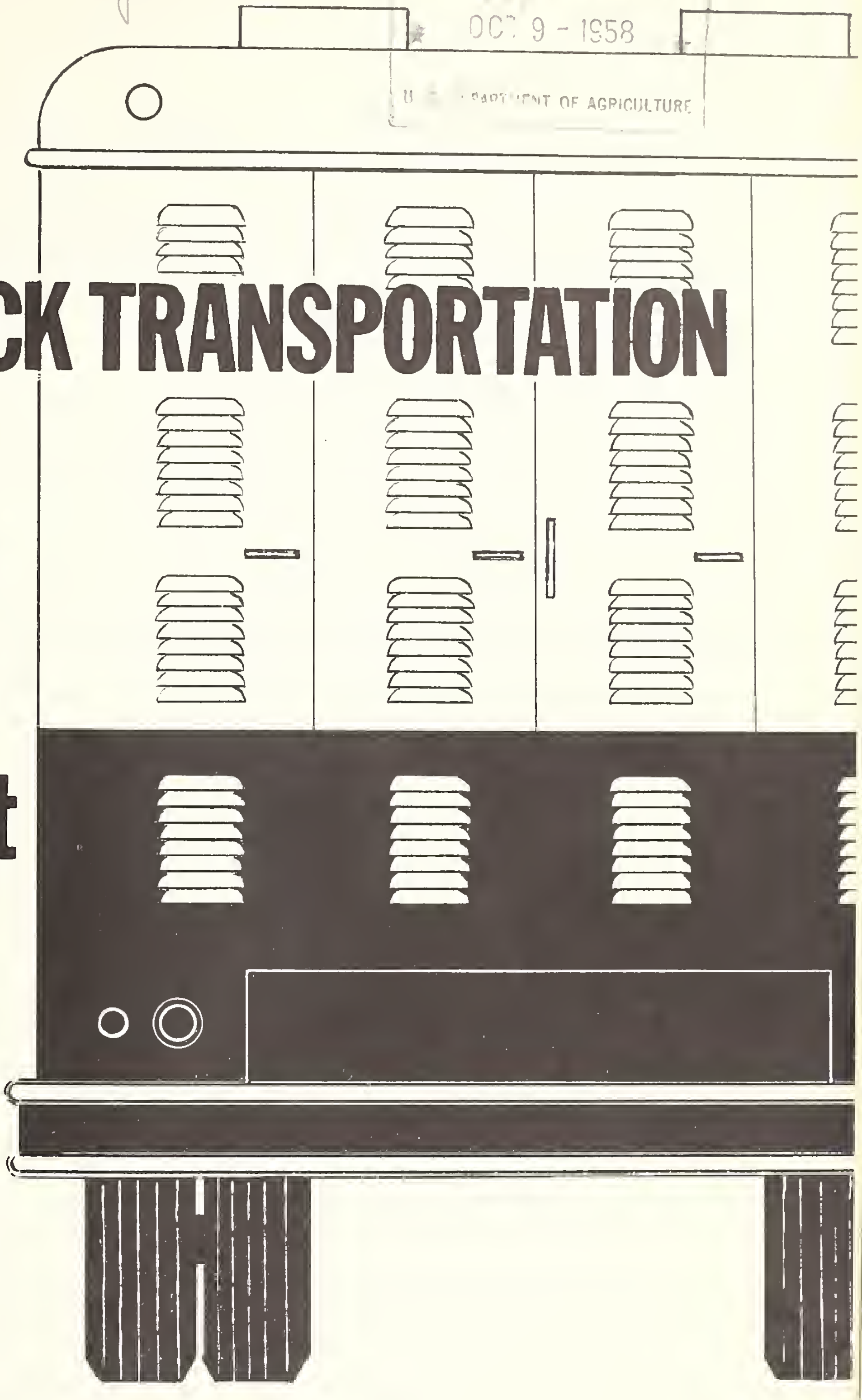
BABY CHICK TRANSPORTATION

Problems and Equipment



Marketing Research
Report No. 267

U.S. DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service Marketing Research Division • • Washington, D.C

PREFACE

This study of the methods used in transporting baby chicks is part of a broad program of research designed to increase the efficiency of the marketing processes for farm products. The study brings together information on some of the problems encountered and the equipment used in transporting baby chicks. Hatcherymen in all major areas of chick production were interviewed.

August 1958

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BABY CHICK TRANSPORTATION PROBLEMS AND EQUIPMENT

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Transportation and Facilities Branch
Agricultural Marketing Service

SUMMARY

The conditions under which chicks are transported and the types of equipment employed vary widely throughout the country. This report shows how hatcherymen have successfully met some of the problems encountered under difficult conditions so that others may benefit from their experience and ingenuity.

Special motortruck equipment and accessories, many home-designed and often home-built, are responsible for keeping to a minimum shipping losses from smothering, overheating, or mishandling of chicks. Motor vehicles ranging in size from station wagons to tractor semitrailers transport most of the chicks that are hatched. In some areas parcel post and railway express still handle a few shipments. Air freight is popular among firms shipping overseas, but relatively few chicks are transported within the United States by air.

Chicks may be safely transported at the recommended air temperature of about 90° F. inside the chick boxes with the help of specialized intake fans, exhaust fans, heaters, refrigeration units, and load spacers. This equipment also removes the carbon dioxide created by the chicks and provides the necessary amount of fresh air to satisfy their oxygen requirements.

With the help of properly trained drivers and this specialized truck equipment, hatcherymen are making successful deliveries in all types of weather to both local and distant customers.

INTRODUCTION

The trend of the poultry industry is toward greater use of motortrucks for the transportation of baby chicks. In 1957, approximately 2.1 billion chicks were hatched commercially and most of them were delivered to poultrymen by truck. Hatcherymen formerly shipped the majority of their production via parcel post or railway express. However, in recent years the curtailment of local rail service and the increased demand from poultrymen for fast deliveries of large shipments have brought about this change to motortruck transportation.

Competition between hatcheries for the poultryman's business has also been an influencing factor in this transition to motortrucks. In order to remain in business, the hatcheryman must deliver his chicks at a scheduled time in good condition. The only positive method by which he can do this is to maintain complete control over the chicks at all times, from the incubator to the farm. By using trucks he can accomplish this for local or distant customers. An experienced driver-attendant, who has a direct interest in delivering chicks in good condition, usually accompanies every shipment to insure the maintenance of a proper environment at all times. This complete control and personal attention to the chicks' comfort in transit have made motortrucks the most popular mode of chick transportation today.

All hatcherymen are faced with the same basic problems when delivering chicks. They must strive to maintain environmental conditions as close as possible to that which is considered ideal. They must avoid overheating or chilling the chicks, and the ill effects which follow these conditions. Provision must be made to supply heat in cold weather and eliminate excessive heat in warm weather. Personnel must be properly trained for handling chicks at loading time, during transit, and while unloading to avoid unnecessary losses. Fortunately, the baby chick is not so fragile as his appearance indicates and can tolerate some variation from the ideal conditions without harm. However, good shipping results can come only with constant attention to the details which keep the chicks comfortable.

Air cargo service is being widely used in the export trade for shipping chicks overseas. This is a specialized field and necessarily limited according to the value of the birds and shipping distance involved. The shipping costs range from 2 to 30 cents per bird on overseas shipments. Air transportation within the United States is limited, primarily due to cost.

ENVIRONMENTAL REQUIREMENTS OF CHICKS

Chicks cannot tolerate unusually high or unusually low temperatures. They survive best when the air surrounding them is at approximately 90° F. In addition, sufficient fresh air must be provided to satisfy the oxygen requirements and remove the carbon dioxide created by the chicks. The carbon dioxide level in the air should not be allowed to rise above the 0.5 percent level.

In 1936, Barrott, Byerly, and Pringle 1/ determined the heat output (B.t.u.'s), the oxygen requirements, and the amount of carbon dioxide expelled per baby chick at different environmental temperatures. The results of that study are shown in table 1.

The values in table 1 were obtained under controlled laboratory conditions and therefore, do not reflect the actual amount of fresh air that needs to be brought into the truck while in transit. The type of shipping box, method of stacking, truck body design, and fan capacity are some of the factors that

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1/ Barrott, H. G., Byerly, T. C., and Pringle, E. M. Energy and Gaseous Metabolism of Normal and Deutectomized Chicks Between 10 Hours and 100 Hours of Age. Jour. Nutr. 11(3). March 1936.

Table 1.--Metabolism changes in baby chicks as related to environmental temperature variations

Environmental temperature °F.	Heat produced per chick per hour	Air needed per chick per hour to supply oxygen requirements	Carbon dioxide expelled per chick per hour
	B.t.u.	Cubic feet	Cubic feet
68	1.61	0.0159	0.0025
72	1.53	.0153	.0023
76	1.40	.0141	.0022
80	1.25	.0130	.0020
84	1.07	.0106	.0016
88	.88	.0094	.0014
92	.74	.0093	.0011
96	.74	.0071	.0010
100	.89	.0077	.0012
104	.94	.0088	.0014
108	1.00	.0091	.0015

influence fresh air circulation through the load in the truck during transportation. Some of the fresh air brought into the truck passes through the cargo area directly to the exhaust opening without benefit to the chicks inside the boxes. In order to meet the oxygen requirements and to remove the carbon dioxide produced, a greater amount of fresh air must be brought into the truck than the quantities shown in table 1.

Recent work at the Poultry Department of the University of California indicates that, with good circulation, about 2 cubic feet of fresh air per minute per 100 chicks will supply sufficient oxygen and remove unwanted carbon dioxide. 2/ The California study also disclosed that an inside box temperature of 90° F. can be readily maintained when the ambient air in the truck is 60° to 70° F.

In colder climates hatcherymen have found the volume of fresh air brought in can be reduced to about 1 cubic foot per minute per 100 chicks to conserve heat and prevent the chicks from being chilled. However, when this volume is reduced it is even more important to maintain adequate circulation throughout the load so that the available air can be fully utilized to maintain the carbon dioxide level below 0.5 percent tolerance.

The maintenance of desirable conditions inside the truck in regions where the climate is moderate is not difficult. However, in areas with very high temperatures it becomes a problem to induce sufficient fresh air into the

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2/ Unpublished data obtained through correspondence with W. O. Wilson, University of California, Davis, Calif.

truck to remove the heat generated within the chick box. If the high temperatures are accompanied by high humidity, it is even more difficult for the chicks to lose heat through evaporation. If the high temperatures are accompanied by very low humidity, care must be taken that the chicks do not dehydrate as a result of circulating large quantities of dry air. Commercial humidifiers are available which can be used to maintain the proper humidity.

TYPES OF EQUIPMENT

Many types of equipment are being used successfully for transportation of baby chicks. A few truck body builders sell units specifically designed for this purpose. However, many hatcherymen use bodies of their own design or modified stock models. Most of these home-designed, and often home-built, bodies have been developed over a period of years by the hatcherymen themselves Through the costly process of trial and error, and with considerable ingenuity, many operators have installed their own heating, ventilating, and circulation systems in their trucks. In addition, numerous innovations in stacking, handling and in-transit care have helped to eliminate losses that would otherwise occur.

Body Types of Vehicles

Hatcherymen use vehicles with a wide variety of body types for hauling chicks, ranging from station wagons to large tractor semitrailers. These bodies vary with the size of the hatchery, length of haul, size of shipment, and type of chicks. The three most popular types are the walk-in van, conventional cab and body, and the modified school bus, as shown in figures 1, 2, and 3, respectively. Most hatcherymen agree there is a distinct advantage in having the driver seated in the same compartment with the chicks.

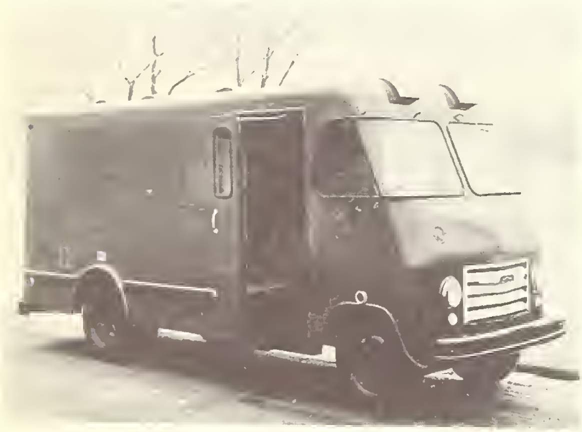

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Figure 1.--Walk-in type of truck used for hauling baby chicks.

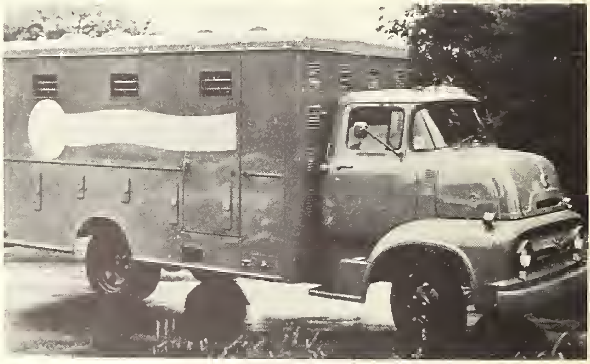

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Figure 2.--Conventional cab and body type of truck used for hauling baby chicks.

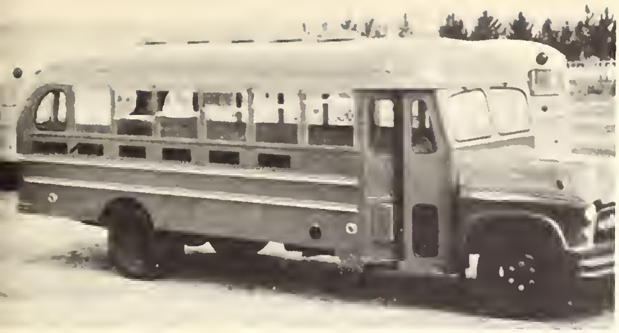

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Figure 3.--School bus used for hauling baby chicks.

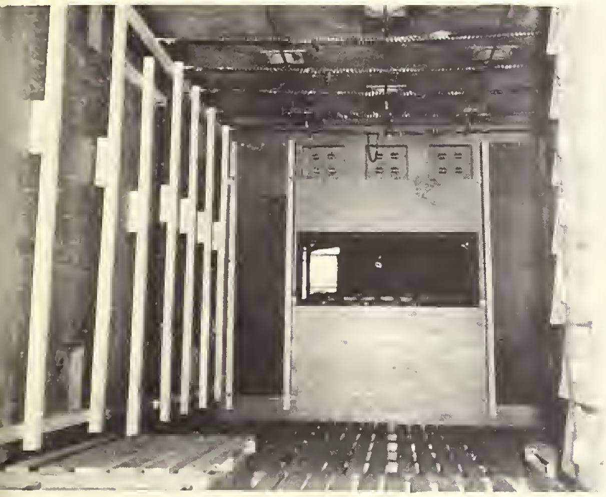

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Figure 4.--Inside view of a truck with rear window of cab removed and opening enlarged.

In keeping the truck comfortable for himself by regulating heat and ventilation, the driver also keeps it comfortable for the chicks. He is close to the chicks and can recognize their first signs of distress or discomfort, as indicated by a change in the tone of their chirps. He can then take immediate steps to correct an undesirable situation. Most users of the conventional type of truck bodies have removed the rear wondow of the cab and constructed a small opening between the cab and body as shown in figure 4. Others have enlarged the rear window opening to allow sufficient space for the driver to pass from the cab directly to the cargo area (fig. 5).

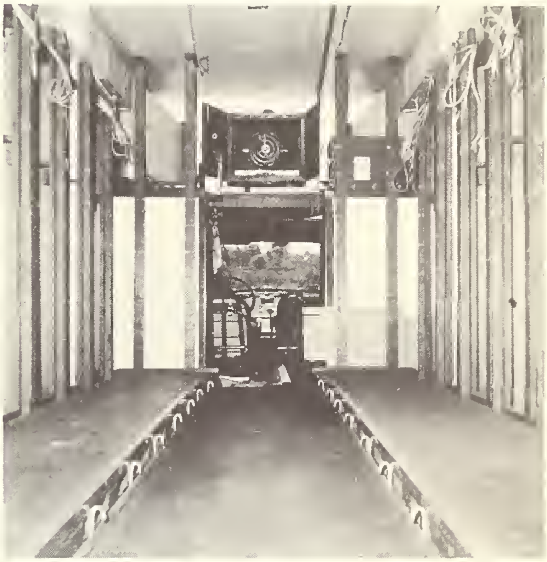

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Figure 5.--Inside view of a truck with a passageway between cab and body.

The smaller vehicles, such as station wagons and pickup trucks, are generally stock models with little or no special adaptations made to the bodies for transporting chicks. These vehicles are generally used for small or local deliveries in addition to other services around the hatchery.

Semitrailer units are not widely used since only the largest hatcheries shipping long distances can warrant their use (fig. 6). The trailers are of standard design with numerous special devices installed for ventilation, circulation, heating, and stacking.

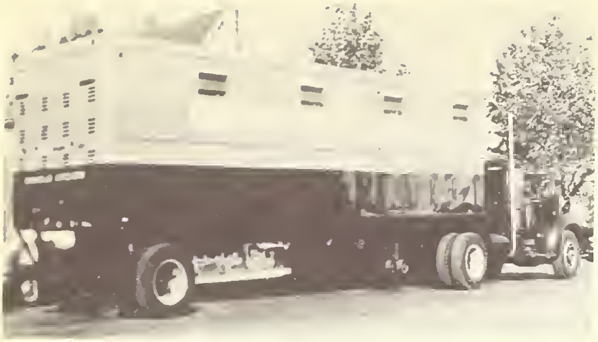

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Figure 6.--Semitrailer unit used for hauling baby chicks.

Ventilation Systems

The majority of hatcherymen agree that the most important factor in successful transportation of chicks is a ventilation system that will provide a continual flow of fresh air around each chick box. This flow of air is necessary to meet the oxygen requirements of the chicks as well as remove the unwanted carbon dioxide. Even when the outside air temperature is near 100° F., the circulation of large quantities of fresh air throughout the truck will help to keep the chicks in good condition.

One of the most popular systems features a false floor for air distribution (fig. 7). Air is admitted at the front of the truck and is conveyed through ducts to the space beneath the false floor. From there it escapes through holes in the floor and thence through the cargo area to exhaust vents in the ceiling.

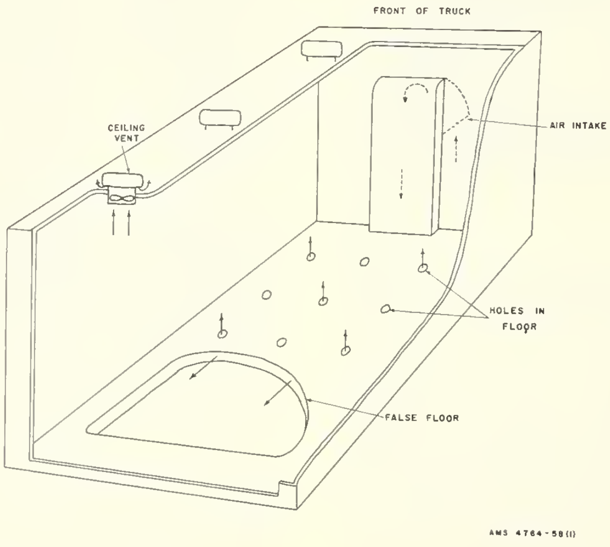

Figure 7.--Ventilation system featuring a false floor.

A false wall is used in some trucks and modified school busses. In these trucks, air is brought in through scoops or blowers in the front and passed through false walls. It then moves through all parts of the cargo area and is finally expelled through roof vents. The school busses take fresh air in through standard windows, as well as through louvers located along each side of the body just below the windows, as shown in figure 3. Air which enters through the louvers flows through a false inner wall and thence through the cargo area to exhaust vents in the roof or rear door. All of the louvers on one side are controlled by a single lever near the driver's seat, as shown in figure 8. The windows are reversed so that the driver can adjust them from the outside without entering the cargo area.

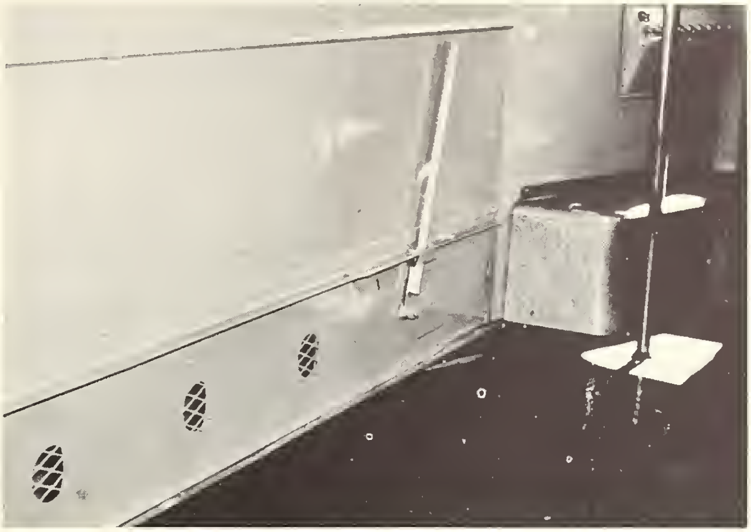

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Figure 8.--Inside of school bus showing lever to control all air inlet vents on one side.

The location, size, and number of the fresh air inlets varies a great deal from truck to truck. Hatcherymen who haul chicks over long distances in all types of weather have found that a large scoop-type air intake is required to supply the necessary amount of fresh air. Figures 1, 9, and 10 illustrate such scoops located above the cab so as to avoid road heat and engine exhaust fumes.

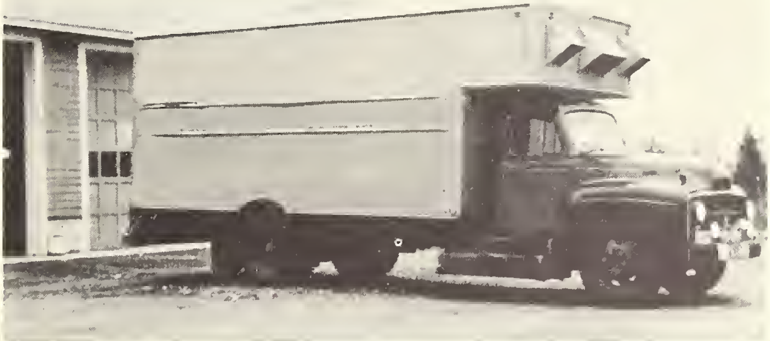

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Figure 9.--Large capacity air scoop with 3 openings above truck cab.

The movement of the truck along the highway will often force sufficient fresh air into the truck. However, the intake and exhaust vents of most trucks are equipped with blowers or fans, as shown in figures 11, 12, and 13. These fans are necessary to insure an adequate air supply when the truck is standing still or moving through slow traffic. The driver regulates these fans by means of a control panel, as shown in figure 14. Many vehicles have small air scoops in other locations on the truck.

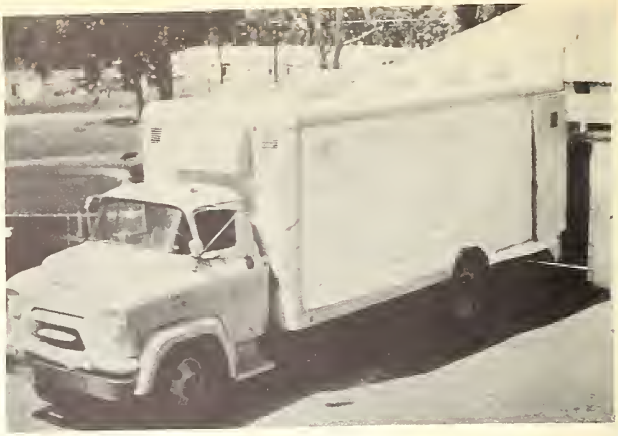

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Figure 10.--Large capacity air scoop with one opening above truck cab.

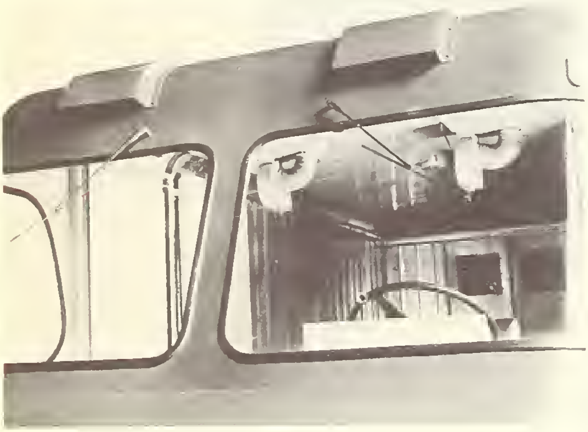

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Figure 11.--Intake blowers located over front window of a truck.

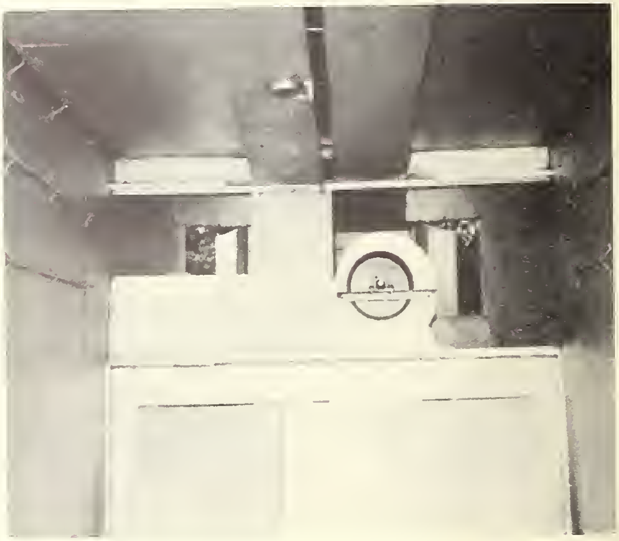

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Figure 12.--Air intake blower located in forward section of a truck.

The purpose of these inlets is to supply additional fresh air to those areas within the vehicle that are difficult to supply and that are consequently a source of chick losses. One of these locations is around a wheel well, and figure 15 shows 2 small scoops designed to provide fresh air for that area.

In addition to air scoops, many trucks also have louvered vents in the front and rear (figs. 16 and 17). However, in cold weather those vents are partially or fully closed.

Some trucks are equipped with a hand-operated mechanism to regulate the openings of all exhaust vents at one time from the outside. By using this device the driver does not have to move or climb over chick boxes to adjust the vents. Such a device with a handle and cable is shown in figure 16.

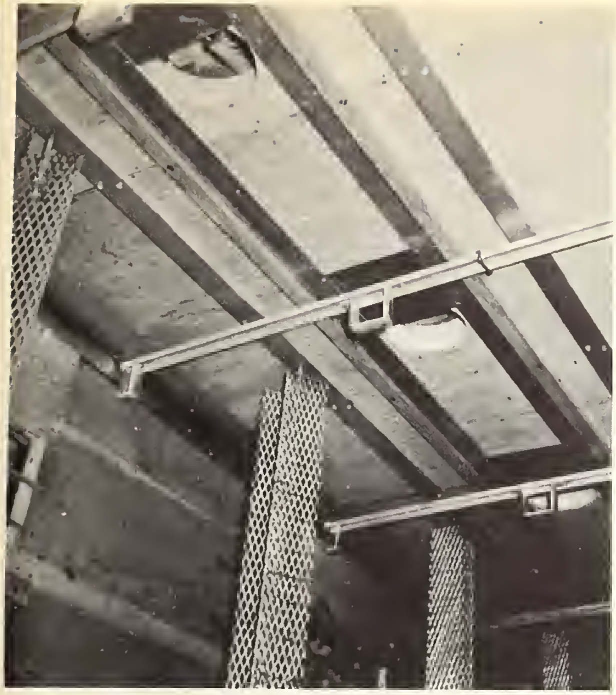

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Figure 13.--Exhaust fans located in ceiling of a truck.

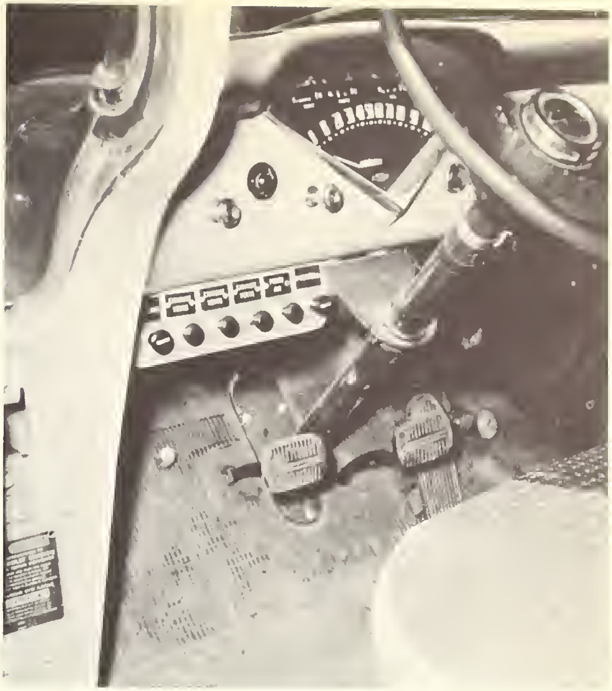

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Figure 14.--Control panel of a truck cab.

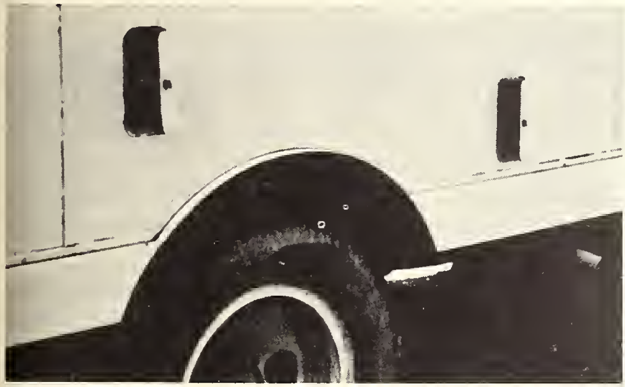

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Figure 15.--Air scoops designed to supply air to the area around the wheel well.

Many trucks are equipped with floor racks to provide adequate circulation of air under the load. The stringers of the racks should not be laid crosswise to the flow of air as this would make it impossible for the air to move under the load and, consequently, impair circulation.

In areas with extremely hot weather, some operators have replaced the regular doors on their vehicles with screen doors in order to supply additional fresh air.

The location of the truck's exhaust pipe outlet in relation to the fresh air intakes is very critical. As a truck moves along the highway, there is a continual swirl of air around the body. This swirl of air may pick up exhaust fumes which are discharged under the body or to the rear and carry them up to vent openings. To eliminate this hazard and resulting losses from carbon monoxide, the exhaust should be directed above the truck.

Many of the features which have been discussed thus far were the result of individual design and homemade changes to standard model bodies; therefore, exact specifications of the vents, blowers, and fans were not available.

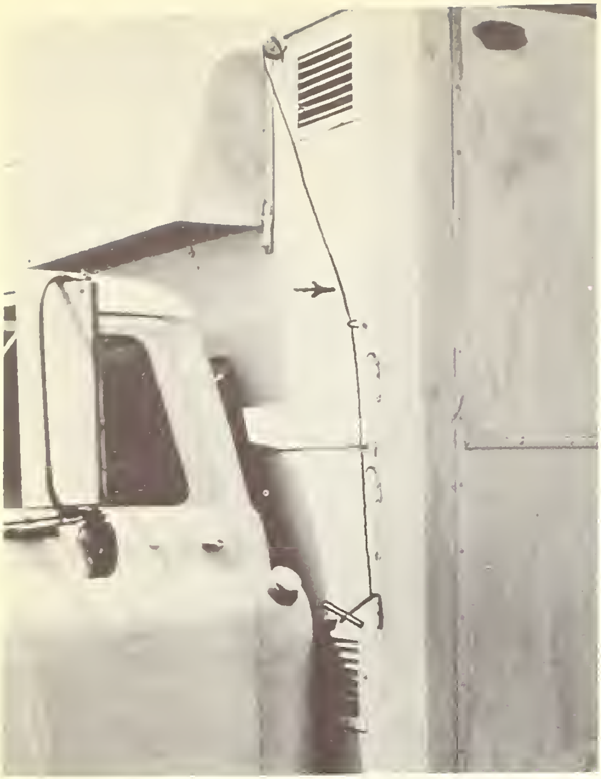

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Figure 16.--Louvered intake vents located in front of truck. Also shown are a handle and cable for adjusting all roof exhaust vents at one time.

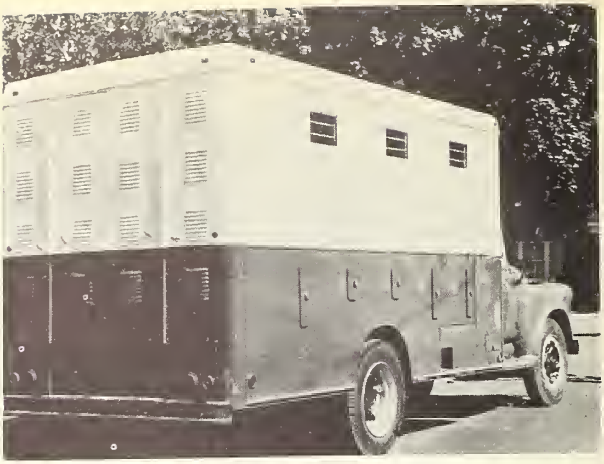

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Figure 17.--Louvered exhaust vents at rear of a truck.

Heating Systems

In cold weather, hatcherymen remove fewer of the punch-out ventilators from the chick boxes than in warm weather, in order to conserve the chicks' body heat. In addition, it is usually necessary to supply heat to maintain a satisfactory air temperature within the truck. The fresh air admitted to the truck to supply oxygen and remove carbon dioxide may lower the inside temperature below the desired level unless heat is added.

In most trucks the engine is the source of heat used in warming the truck body. One hatcheryman used a homemade system consisting of a blower and an old automobile radiator (fig. 18). Hot water was piped from the truck engine to this radiator coil. An electric motor-driver blower forced the fresh air from outside through the radiator and into the cargo area along the floor.

In the school bus bodies a number of hatcherymen have installed a second heater in the rear of the bus to supplement the regular one located in the front near the driver (fig. 19). The use of such individual heaters may produce uneven zones of heat within the truck since the movement of heated air is restricted by the chick boxes. Some hatcherymen place empty boxes immediately surrounding the heaters to avoid losses in these "hot spots." A duct system under the floor, in the walls, or at the ceiling makes it easier to maintain uniform temperatures since the heated air can be evenly distributed to all parts of the truck.

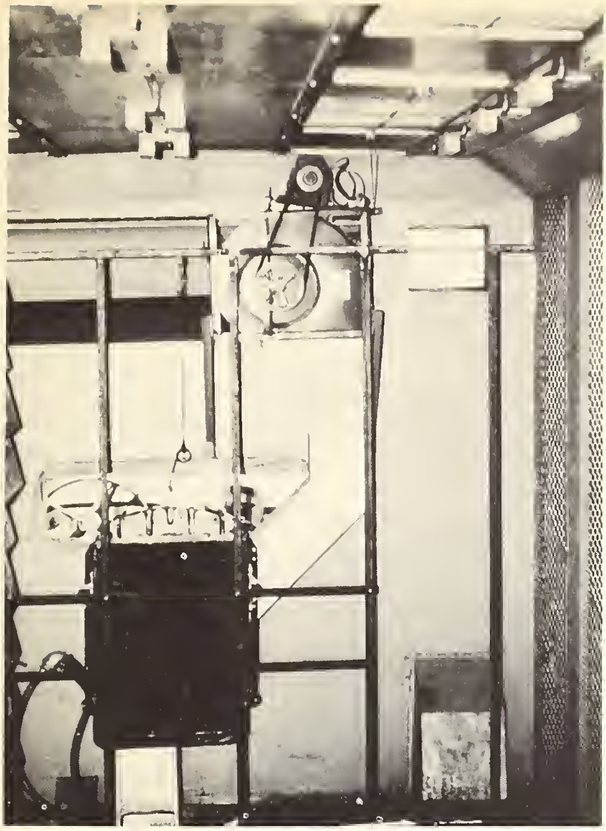

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Figure 18.--Heating system composed of blower and old automobile radiator.

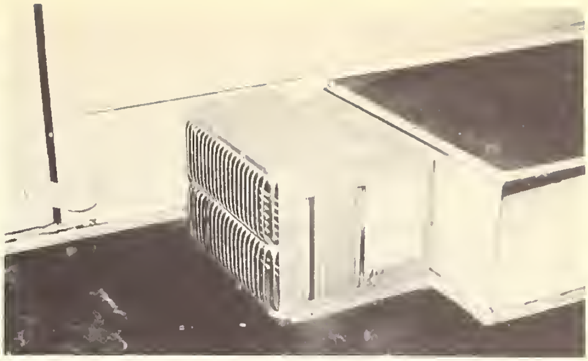

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Figure 19.--Second hot water heater located on floor at rear of school bus.

In the larger conventional type of trucks and tractor semitrailers, the amount of heat from the engine is sometimes insufficient, and a supplemental source must be used. Electric heaters are often employed since the burning of liquid fuel would present a fire hazard, as well as problems in exhausting poisonous combustion gases.

Some heaters are equipped with automatic temperature controls; however, most units are controlled manually by the driver. The driver will keep the truck comfortable for himself at 70° to 75° F. The heat from the chicks will then keep the temperature inside each box at the desired temperature of approximately 90° F. If the driver's cab is separated from the chicks, he must rely upon remote reading thermometers, rather than his own feeling of comfort or the chirping of the birds, to control the temperature. When instruments are used, the driver should make periodic checks en route to be sure they are functioning properly.

Refrigeration Systems

In hot weather all punch-out ventilators and sometimes even the box lids are removed to keep the chicks from smothering. However, when the outside temperature exceeds 95° F., it becomes exceedingly difficult to maintain an inside truck temperature low enough to prevent some chick losses from overheating. Hatcherymen located in hot climates try to haul their chicks during the night or early morning to avoid the heat of the day. However, in many instances the nights are also very hot or the distance to be covered is so great that they are forced to travel during daylight hours. In hot weather a flat tire, motor trouble, or stopping too long for the driver to eat may be disastrous. For this reason a few operators have installed refrigerated units to maintain lower temperatures inside the truck during very hot weather.

So many factors affect the successful operation of an air-conditioned truck that a refrigeration engineer should be consulted for any installation. Some factors to be considered are: The number of chicks to be hauled at one time; the number of air changes required per minute to supply oxygen and remove carbon dioxide; size of the truck body; type and amount of insulation; desired temperature level inside; highest expected outside temperature; color and type of body surface; and the type and size of fans for intake, circulation, and exhaust. Many of these items vary from one operation to another, and it is not possible to make a general recommendation as to the size of refrigeration unit needed. However, the following hypothetical case will illustrate the factors that need to be taken into account and how the resulting heat load may be determined:

1. Outside air temperature, 100° F.

2. Desired air temperature inside, 75° F.

3. Outside surface of 14-foot truck body, approximately 546 square feet.

4. Wall, ceiling, and floor: Aluminum skin outside, 2 inches of insulation, ¼-inch plywood inside lining. In actual use this type of construction will allow heat to pass through it at the rate of approximately 0.32 B.t.u.'s per hour, per degree of temperature difference, per square foot of surface area, or 0.32 x 25 x 546 = 4,368 B.t.u.'s per hour.

5. Number of chicks to be carried, 22,400 in 224 boxes stacked 4 wide, 7 long, and 8 high. The amount of heat given off by the chicks will be approximately 0.8 B.t.u.'s per hour per chick. Therefore, the total heat given off will be 0.8 x 22,400 = 17,920 B.t.u.'s per hour.

6. The amount of fresh air needed to supply oxygen and remove carbon dioxide will be approximately 2.0 cubic feet per chick per hour. Therefore, the air supply needed will be 2.0 x 22,400 = 44,800 cubic feet per hour, or $\frac{44,800}{60}$ = 747 cubic feet per minute.

7. A "rule of thumb" for the amount of heat which must be removed from a given volume of air to lower its temperature a given amount is as follows:

   1.08 x temperature difference x cubic feet per minute = B.t.u.'s per hour.

   In this case the amount of heat to be removed from the incoming fresh air is 1.08 x 25 x 747 = 20,169 B.t.u.'s per hour.

8. The refrigeration unit should have the capacity to remove the following total amount of heat per hour:

	B.t.u./hr.
Heat leakage into truck through walls (item 4)	4,368
Heat given off by chicks (item 5)	17,920
Heat to be removed from fresh air (item 7)	20,169
Total	42,457

Both mechanical and water-ice refrigeration units are used on chick trucks. However, there are conflicting opinions among hatcherymen regarding the use of mechanical refrigeration. Figure 20 shows a mechanically refrigerated truck now being used in California. The owner of this truck claims exceptionally good results and small losses even during hot weather. However, an eastern hatcheryman reported frequent losses in his truck equipped with a mechanical refrigeration unit of insufficient capacity, and he removed the equipment from his truck. Again, this points to the need for a properly engineered unit.

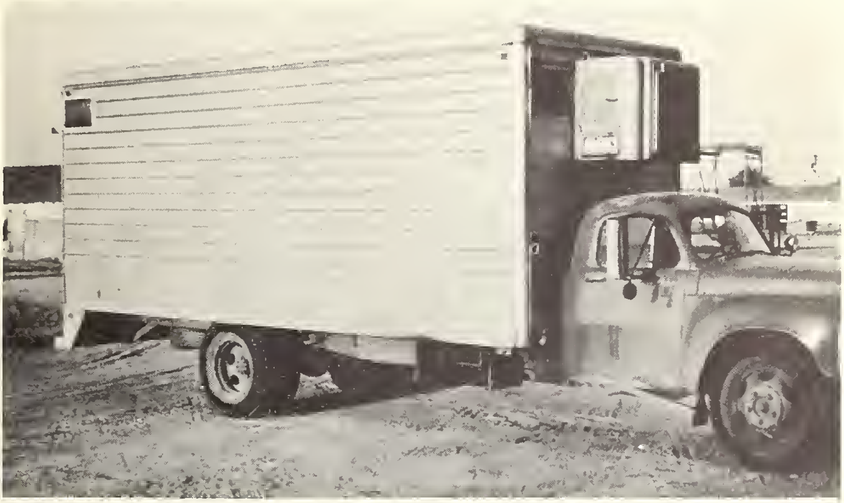

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Figure 20.--Chick transport truck equipped with a mechanical refrigerating unit.

One Texas hatcheryman who used water-ice for refrigeration reported that the ice not only cooled the truck but also provided moisture to reduce the dehydration of chicks in that hot and dry climate. One of his trucks had 2 inches of insulation, false walls, circulation fans, and an ice bunker which was located at the front of the body. The ice bunker in this particular truck had a capacity of about 1,000 pounds of chunk ice and could be re-iced en route on a long haul. A small gasoline engine similar to the type used on produce trucks was used to operate a fan, which forced air through the ice bunker and into the cargo area. The truckdriver reported that with outside temperatures about 100° F. he was able to maintain temperatures in the truck 10° to 15° F. cooler.

Power Supply

Many hatcherymen have reported difficulties in operating their extra equipment from the regular truck electrical system. The additional fans and heaters required for the chicks often overload the regular electrical system, causing damage or failure to the generator, voltage regulator, and battery. This, in turn, can cause fan or heater failure and result in serious losses of chicks. Hatcherymen who have installed larger electrical power supply systems report very few chick losses from suffocation or overheating.

Three possible methods that may be used to provide additional electrical current are as follows:

1. Replace standard truck generator with a larger heavy-duty type of generator. Approximate cost, using 45 ampere, 12-volt generator--$75.
2. Replace standard truck generator with an alternator. Approximate cost, using 60 ampere, 12-volt alternator--$210.
3. Install separate gasoline-powered electric generating unit, as shown in figure 21. Approximate cost of 1,000 watt, 110-volt unit--$300.

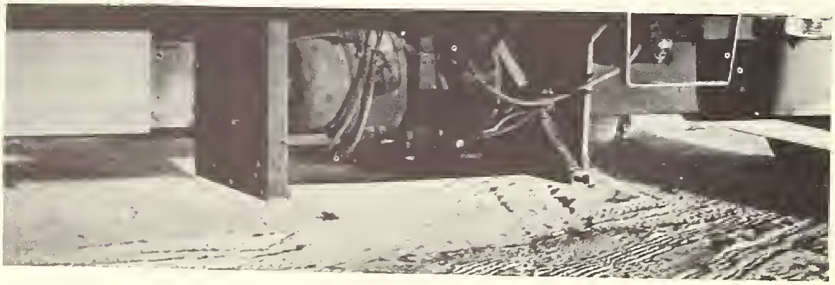

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Figure 21.--Separate gasoline-powered generator mounted underneath body of chick transport truck.

When considering the need for additional electrical power the total amperage required to operate the truck, its accessories, and all auxiliary chick equipment should be determined. Approximately 20 amperes should be allowed to cover operation of the engine, lights, and cab accessories. This amount (20 amperes) should be subtracted from the rated capacity of the truck engine generator. If the difference will not take care of other equipment, additional electrical generating power must be installed.

Even though the gasoline-powered generator is more costly, it has features which make it more desirable than the other two methods suggested. It is more powerful and, since it is a separate system, the regular truck electrical system will not be overloaded. It is also not affected by truck engine failure. When the truck is traveling in heavy city traffic, or is at a standstill, it is not necessary to speed up the truck engine to obtain sufficient electrical output as with the other methods.

Large capacity intake fans may be powered directly by means of a gasoline engine with V-belt drive. Such a unit mounted in the nose of a semitrailer is shown in figure 22.

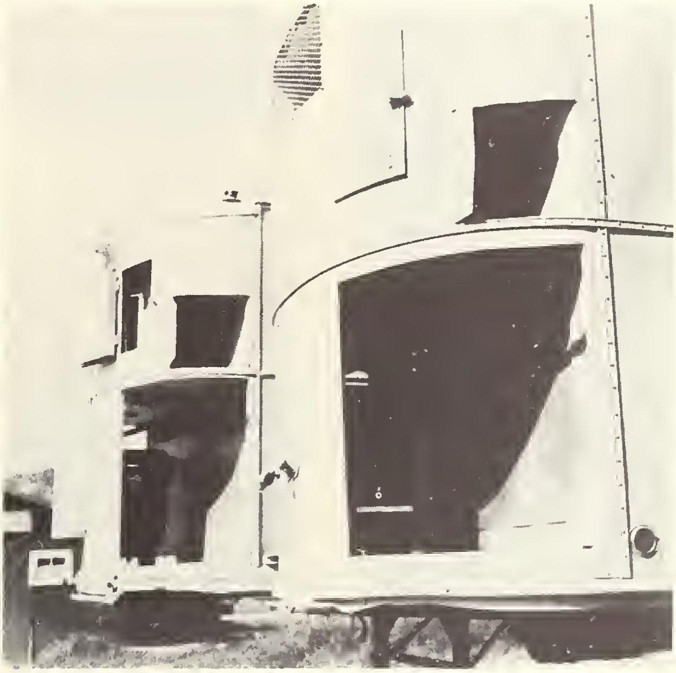

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Figure 22.--Gasoline engine with V-belt drive mounted in nose of a semitrailer to power fan located in large, screened air intake scoop.

Handling and Stacking Chick Boxes

Proper handling and stacking of chick boxes in the truck is necessary for successful transportation. Boxes must be stacked and spaced properly to allow free air movement around the chicks. The day-old chick can stand some bumping and jolting but repeated mishandling will result in losses. Hatcherymen must be continually alert to prevent rough handling by driver and loading crews.

A New England hatcheryman uses a metal rack built to hold 24 boxes (fig. 23). The rack is equipped with casters so that after being loaded with chick boxes, it is wheeled directly into the truck. A simple tie-down device is used to hold the racks in place during transit.

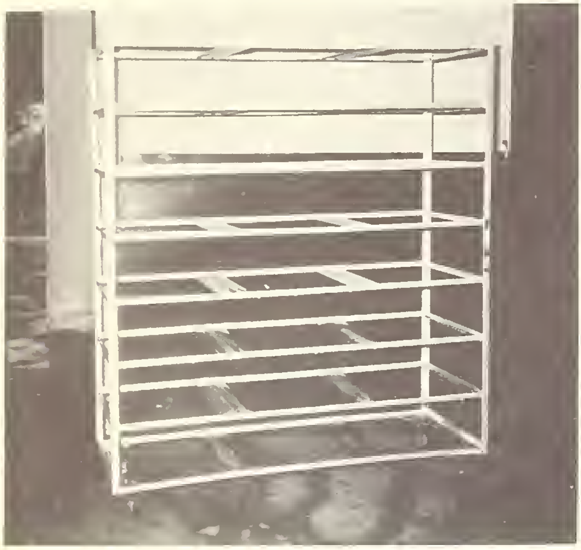

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Figure 23.--Metal rack with casters built to hold 24 chick boxes.

Another hatcheryman built small pallets with a square of foam rubber attached to the top side of the pallet to provide a cushion for the stacked boxes. Each pallet holds one stack of boxes. The operator believes that this arrangement reduces vibration and road shock and therefore reduces losses. This same operator also found that by adding a concrete slab for weight to the underside of the truck body he was able to flex the otherwise stiff springs of the truck, thereby giving a smoother ride.

Chick boxes must be stacked and held in place in the truck to allow free movement of air around the boxes. To accomplish this, operators use special dividers, spacers, and tie-down devices (figs. 24, 25, 26, and 27). Without such devices the movement of the truck over the road would cause the boxes to shift position and thus close off some of the air passages.

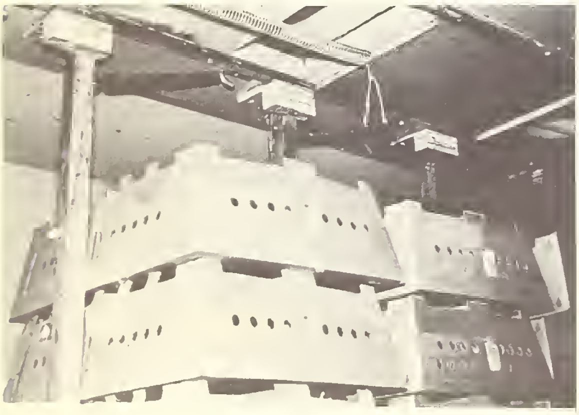

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Figure 24.--Vertical spacer held in place against the chick boxes by means of a spiral spring at top under tension.

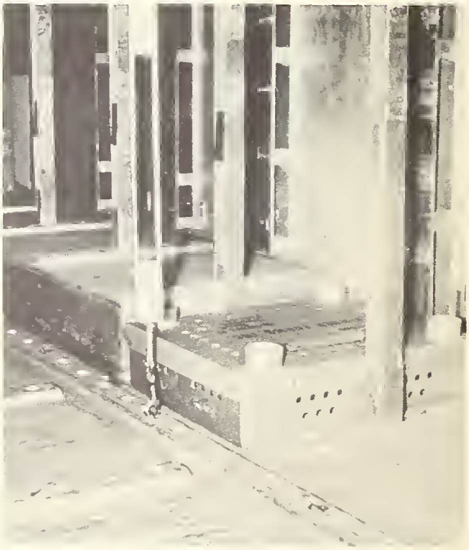

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Figure 25.--A vertical spacer featuring small spiral spring and harness snap at the bottom.

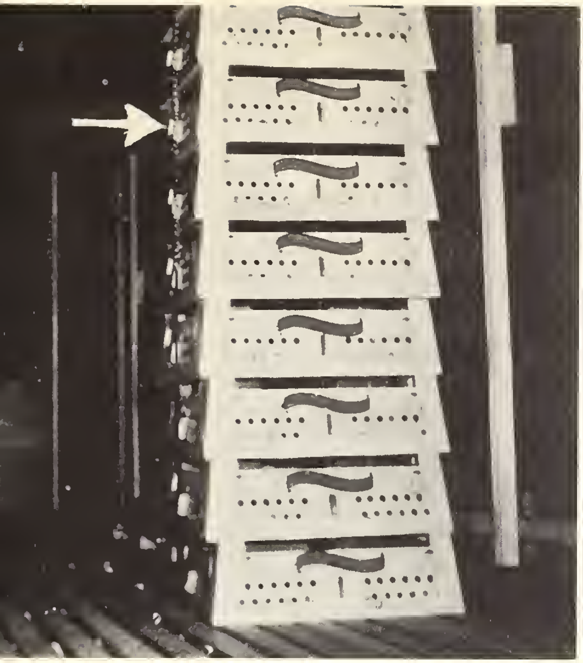

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Figure 26.--Tie-down device consisting of a light chain and screen door spring under tension.

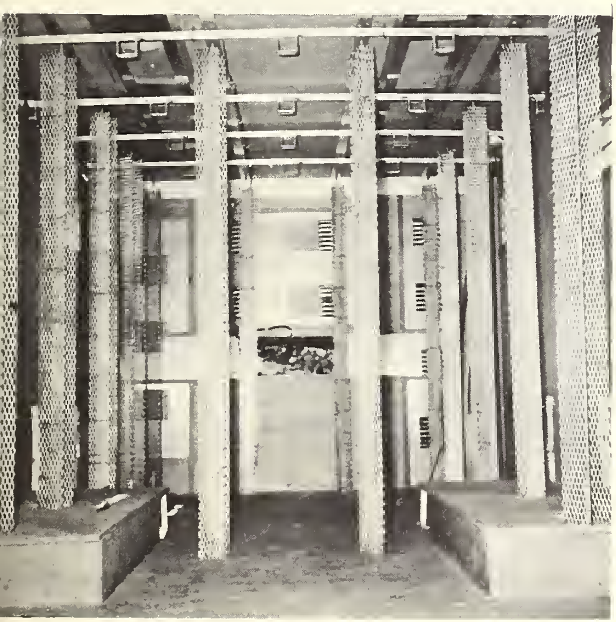

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Figure 27.--Vertical spacer posts made of expanded metal to aid in circulation of air.

In addition to space between the boxes, provision must also be made for air space between the boxes and the truck walls. Direct contact of the chick box with the truck wall would allow heat to flow inward in hot weather and outward in cold weather having a marked influence on the inside box temperature. Wall strips, as shown in figure 4, page 5, figure 5, page 5, and in figure 28 should be used to provide air space.

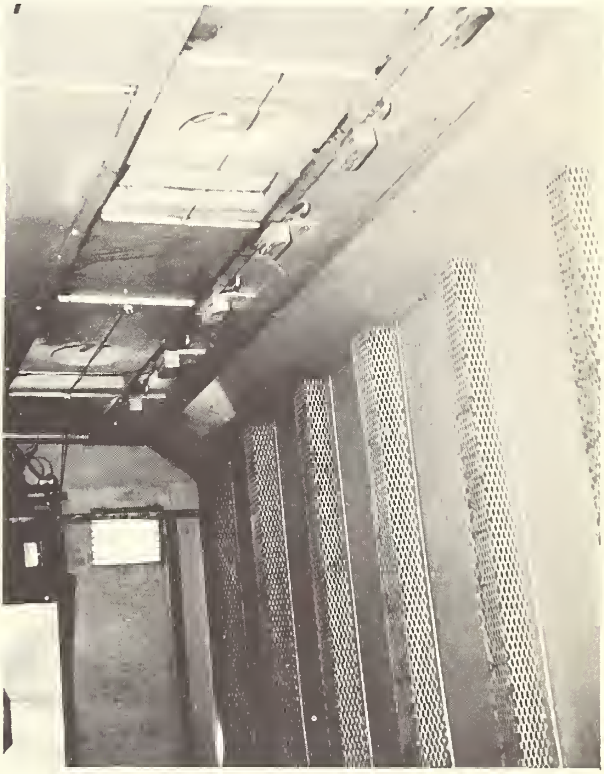

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Figure 28.--Expanded metal wall strips used to provide space between the chick boxes and the truck wall.

A California hatcheryman has installed a system of racks in his truck which allows most of the loading to be done from the rear door. Angle iron shelves extend along each wall for the entire length of the truck (fig. 29). Boxes are placed in the rack at the

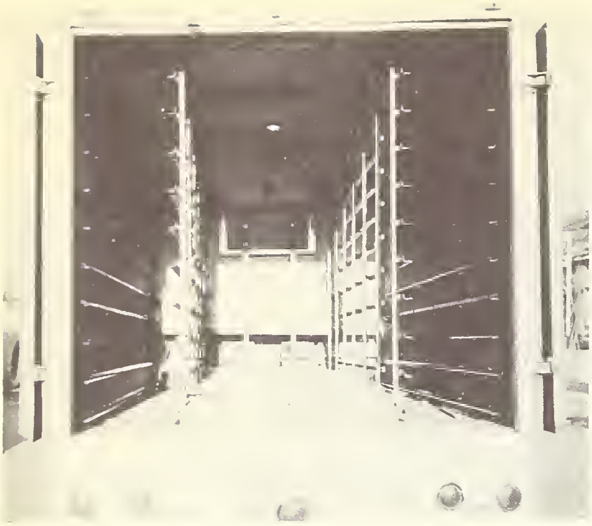

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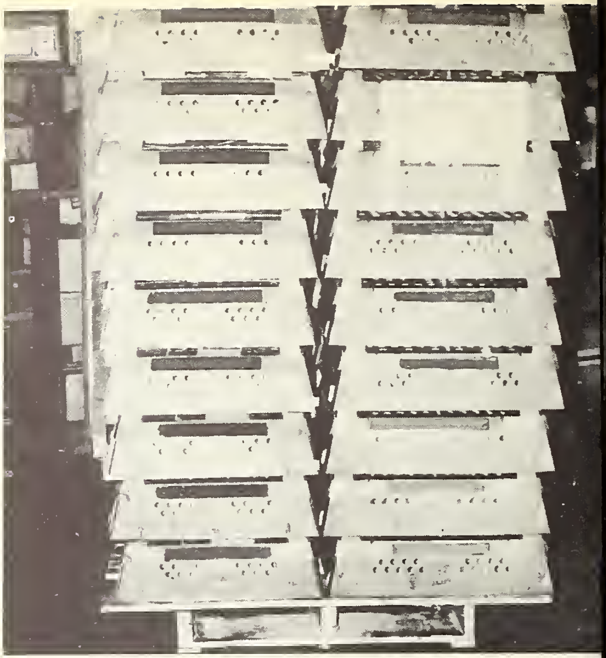
Figure 29.--Trailer with built-in load racks.



BN-5746

Figure 30.--Palletized load of chick boxes as used by an airline company for handling before shipment.

rear and each box is used to push the preceding box forward. The boxes slide forward easily and loading can be accomplished with a saving of many steps. The shelves also prevent shifting of the load and provide space for air circulation. The center of the truck is loaded in the usual manner with wooden spacers placed between the boxes to provide air passageways.

An airline company uses a palletized load that consists of two stacks of boxes (fig. 30). A triangular-shaped fiberboard spacer is used to provide air space between pallet loads in the plane (fig. 31).

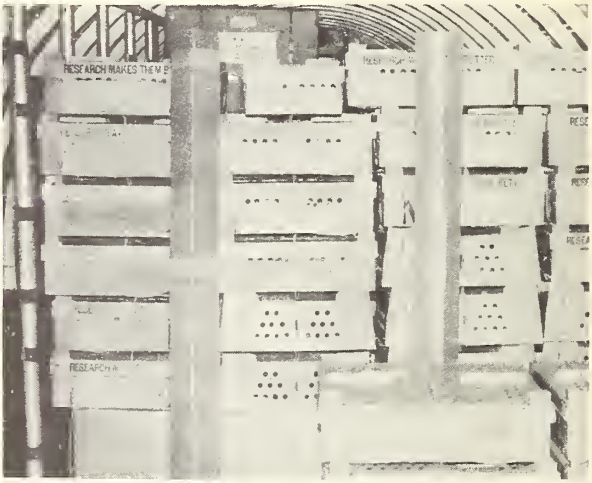


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Figure 31.--Triangular-shaped fiberboard spacers used in air shipment of chick boxes to insure passageways for circulation of air.

DRIVER TRAINING

A well trained driver is an important factor in successful chick deliveries. In many instances the driver is a former hatchery worker or has combined duties in hatchery work and driving. This type of person is generally familiar with chicks and how they should be handled. However, for longer over-the-road deliveries a professional driver is often employed who has little or no poultry experience.

In either case, many hatcherymen have set up a list of standard practices to be followed by the driver. Following is a list which represents some of these practices:

1. Check all mechanical operations of the truck before loading time. This includes gassing and checking tires, fans, etc. A stop for any reason after loading on a hot day could result in a sizable loss of chicks.

2. Adjust all vents, fans, and heaters or coolers in accordance with the local weather conditions. Never close the fresh air intake or exhaust vents completely.

3. Make stops en route only when absolutely necessary. Do not stop for long periods of time.

4. When stops are made in hot weather, park the truck in the shade.

5. In the event of truck breakdown in hot weather, and if the temperature inside the truck begins to rise, unload chick boxes and place them in the shade.

6. Make regular checks on the temperature in the cargo area and inspect all boxes which are accessible. In cold weather adjust the temperature in the truck to the comfort of the driver (about 70° F.).

7. Be alert for any irregular conditions as indicated by increases and changes in the chirping of the birds.

8. Avoid heavy city traffic and routes of known congestion whereever possible.

9. When riding ferry boats, request space at the front of the loading area to insure adequate fresh air.

10. Eliminate "cowboy" type driving practices. Quick stops and starts and fast turns cause unnecessary jolting and will result in losses.

11. When interstate shipments are made, both driver and truck must comply with safety regulations and hours of service requirements of the Interstate Commerce Commission.

CONCLUSIONS

Hatcherymen throughout the country are successfully hauling baby chicks in large numbers over long distances in all types of weather. Much of this success is the result of individual experience gained over a period of years through trial and error methods in developing both equipment and handling techniques. Climate, length of haul, traffic conditions, and other factors which bear directly upon the safe transportation of chicks vary so widely in different parts of the country that it is not feasible to recommend one type of truck that would be suitable to meet all conditions. The truck should be designed to meet the particular conditions encountered by each hatcheryman.

A wide variety of truck body types, air circulation systems, refrigeration units, and stacking and handling methods are being used successfully. This fact indicates that so long as the basic physiological requirements of the chicks are met the actual equipment and techniques employed during transit are optional. However, a trend toward certain basic equipment design and operating techniques was found in the majority of hatcheries visited. The general features in design and operation which most hatcherymen seem to prefer are as follows:

1. A truck in which the driver's compartment is connected to, and not separated from, the chick cargo area.

2. Location of the fresh air intake high above the driver's cab.

3. An air distribution system in which the air enters the cargo area from floor racks or through holes in a false floor.

4. Use of fans or blowers to circulate air, especially when the truck is not in motion.

5. A means for cooling or heating the air in those areas which experience extremes of climate.

6. A stacking method in the truck which will allow free air movement around each of the chick boxes.

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